seem to indicate that he is alive to the inconveniences of this practice; and his selection of the Royal Society's List of Scientific Papers as a model points in the same direction. We can only say that we hope his proposals may be carried out upon, or nearly upon, the lines indicated in his report; in this case he and his collaborateurs will richly merit the thanks of all palaeontologists. Under favourable circumstances he thinks the first volume might appear in from two to three years, and the whole be finished in from eight to ten years!

## Selenotropism in Plants. By M. C. MUSSET.

Being struck with the influence exerted by light of very little intensity upon the so-called heliotropic movements of plants, the author, in order to vary the experiments, adopted the reflected light of the moon as his sole illumination. He sowed in pots seeds of plants well known for their phototropic sensibility, such as Lens esculenta, Mönch, Ervum lens, Linn., Vicia sativa, Linn., &c. When the young plants were a few centimetres long he placed them in a very dark place, where they remained until the night of the experiment. The stems became slender, long, and white; the leaves, which were but little developed, alone had a slightly yellow tinge. During the night of 23-24th February, with a very clear sky, these seedlings were placed in a large window looking to the south, so that they received the direct light of the moon from 9 P.M. to 3 A.M. After a very few minutes of exposure the stems became bent, with the concavity and the terminal bud always presented to the moon, and following it in its course; only about 2 A.M., owing to the changed position of the moon, the bow became nearly straight. The scedlings were then carried to another window looking westward; and a new influence was produced, and continued until the moment of the disappearance of the moon behind the mountain. After a pause of a few minutes the stems then erected themselves more or less under the influence of internal causes and geotropism. To these movements, which he observed for three successive nights, the author gives the name of selenotropism .- Comptes Rendus, March 5, 1883, p. 663.

## Jumping Seeds and Galls\*. By CHARLES V. RILEY.

Having recently received some fresh specimens of so-called "Mexican Jumping Seeds," or "Devil's Beans," as they are popularly called, I take occasion while yet they are active to exhibit them to the society. It will be noticed that these seeds are somewhat triangular, or of the shape of convolvulus-seeds, there being two flat sides meeting at an obtuse angle, and a convex one, which has a median carina. They not only roll from one side to another, but

\* Read before the Biological Society of Washington, November 24, 1882.

actually move by jerks and jumps, and will, when very active, jump at least a line from any object they may be resting on. The actual jumping-power has been doubted by some writers; but I have often witnessed it. To the uninitiated these movements of a hard seed seem little less than miraculous. They are induced by a plump, whitish, lepidopterous larva which occupies about one fifth of the interior, the occupied seed being, in fact, but a hollow shell, with an inner lining of silk which the larva has spun. The larva looks very much like the common apple-worm (Carpocapsa pomonella), and belongs, in fact, to the same genus. It resembles it further in remaining for a long time in the full-grown larva state before transforming, so that the seeds will keep up their motion throughout most of the winter months. When about to transform, which is usually in the months of January and February, it cuts a neat circular door in the convex side of its house, strengtheus the same with silk, spins a loose tube of silk within the seed, and therein transforms to the pupa state. The moth soon afterwards pushes its way out from the little door prepared for it.

The moth was first described in 1857 as Carpocapsa saltitans by Prof. J. O. Westwood\*, and afterward as Carpocapsa Dehaisiana by Mons. H. Lucas<sup>†</sup>.

In regard to the plant on which these seeds occur there is much yet to learn; and I quote what Mr. G. W. Barnes, president of the San Diego Society of Natural History, wrote me in 1874 concerning it, in the hope that some of the botanists present may recognize it :--

"ARROW-WEED (Yerba de flecha).—This is the name the shrub bears that produces the triangular seeds that during six or eight months have a continual jumping movement. The shrub is small, from 4 to 6 fect in height, branchy, and in the month of June and July yields the seeds, a pod containing three to five seeds. These seeds have each a little worm inside. The leaf of the plant is very similar to that of the garambullo, the only difference being in the size, this being a little larger. It is half an inch in length and a quarter of an inch in width, a little more or less. The bark of the shrub is ash-coloured; and the leaf is perfectly green during all the seasons. By merely stirring coffee, or any drink, with a small branch of it, it acts as an active cathartic. Taken in large doses it is an active poison, speedily causing death unless counteracted by an antidote."

In a recent letter he states that he is informed that the region of Mamos, in Sonora, is the only place where the plant grows; that the tree is about 4 feet high, and is a species of laurel, with the

\* Proc. Ashmolean Soc. of Oxford, 1857, t. iii. pp. 137, 138; see also Trans. Lond. Ent. Soc. ser. 2, 1858, t. iv. p. 27, and Gard. Chron. 1859, Nov. 12, p. 909.

† "Note sur les grains d'une Euphorbiacée de Mexique sautant au dessus du sol par les vibrations d'une larve de l'ordre des lépidoptères vivant en dedans," Ann. Soc. Ent. de France, sér. 3, t. vi. Bull. pp. 10, 33, 41, 44 (1859), t. vii. pp. 561-566.

leaves of a dark varnished green. "It bears the seeds only once in two years. The tree is called *Brincador* (jumper), and the seeds are called *Brincaderos*. The seeds are more quiet in fair weather, and lively on the approach of a storm."

Prof. Westwood mentions the fact that the plant is known by the Mexicans as "*Colliguaja*;" and Prof. E. P. Cox, formerly State Geologist of Indiana, now living on the Pacific coast, informs me that the shrub has a wood something like hazel or whahoo; that the leaf is like a broad and short willow leaf. He confirms the statement as to its poisonous character; that a stick of the shrub, when used by the natives to stir their "penola" (ground corn-meal, parched), purges, and that the shrub is used to poison arrowheads. The plant is undoubtedly Euphorbiaccous.

The peculiarity about this insect is that it is the only one of its order, so far as we know, which possesses this habit; and it is not easy to conceive of what benefit this habit can be other than the possible protection afforded by working the seed, after it falls to the ground, into sheltered situations.

The true explanation of the movements of the larva by which the seed is made to jump was first given by me in the 'Transactions of the Saint Louis Academy of Science' for December 6, 1875 (vol. iii. p. exci).

The jumping-power exhibited in this "seed," however, is triffing compared with that possessed by a little gall which I also exhibit. This gall, about the size of a mustard-seed, and looking very much like a miniature acorn, is found in large numbers on the underside of the leaves of various oaks of the white-oak group, and has been reported from Ohio, Indiana, Missouri, and California. It falls from a cavity on the under side of the leaves, very much as an acorn falls from its cup, and is sometimes so abundant that the ground beneath an infested tree is literally covered. It is produced by a little black Cynips, which was described as Cynips saltatorius by Mr. Henry Edwards. The bounding motion is doubtless caused by the larva which lies curved within the gall, and very much on the same principle that the common cheese-skipper (Piophila casei) is known to spring or skip. Dr. W. H. Mussey, of Cincinnati, in a communication to the Natural History Society of that city, December 1875, states, in fact, that such is the case, though members of the California Academy who have written on the subject assert that the motion is made by the pupa, which I think very improbable. At all events the bounding motion is great, as the little gall may be thrown 2 or 3 inches from the earth; and there are few things more curious than to witness, as I have done, a large number of these tiny galls in constant motion under a tree. They cause a noise upon the fallen leaves that may be likened to the pattering of rain.—Proc. United States Nat. Mus. p. 632.